WHAT IS CLAIMED IS:

1   1.   A method of estimating engine torque loss due to a fan
2   comprising the steps of:
3   compiling a table of maximum fan torque losses at a plurality of
4   engine speeds;
5   configuring an engine control unit (ECU) with the table of maximum
6   fan torque losses;
7   retrieving from the table a first maximum fan torque loss and a
8   second maximum fan torque loss for an engine speed;
9   interpolating between the first maximum fan torque loss and the
10   second maximum fan torque loss to estimate a maximum fan torque loss for the
11   engine speed; and
12   calculating an engine torque loss estimate by adjusting the maximum
13   fan torque loss based on a set of predetermined fan characteristics.

1   2.   The method according to claim 1 wherein adjusting the
2   maximum fan torque loss based on the set of predetermined fan characteristics
3   comprises the steps of:
4   determining if the fan is a single speed fan;
5   determining if the fan is operating;
6   setting the engine torque loss estimate at zero if the fan is not
7   operating; and
8   setting the engine torque loss estimate at the maximum fan torque loss
9   if the fan is operating and the fan is a single speed fan.

1   3.   The method according to claim 2 wherein adjusting the
2   maximum fan torque loss based on the set of predetermined fan characteristics
3   further comprises the steps of:
4   determining if the fan is a two speed fan;
5   determining the operating speed of the fan;
6   setting the engine torque loss estimate at zero if the fan is not
7   operating;

8   setting the engine torque loss estimate by multiplying the maximum

9   fan torque loss by a speed scale factor if the fan is a two speed fan operating at low

10   speed; and

11   setting the engine torque loss estimate at the maximum fan torque loss

12   if the fan is a two speed fan operating at high speed.

1   4.   The method according to claim 3 wherein adjusting the

2   maximum fan torque loss based on the set of predetermined fan characteristics

3   further comprises the steps of:

4   determining if the fan is a dual type fan;

5   determining how many fans are operating;

6   setting the engine torque loss estimate at zero if both fans are not

7   operating;

8   setting the engine torque loss estimate by multiplying the maximum

9   fan torque loss by an adjustable scale factor if the fan is a dual fan and only one fan

10   is operating; and

11   setting the engine torque loss estimate at the maximum fan torque loss

12   if the fan is a dual fan with both fans operating.

1   5.   The method according to claim 4 wherein each of the dual

2   fans are the same and the adjustable scale factor is 0.5.

1   6.   The method according to claim 4 wherein adjusting the

2   maximum fan torque loss based on the set of predetermined fan characteristics

3   further comprises the steps of:

4   determining if the fan is a variable speed fan;

5   setting the engine torque loss estimate at zero if the fan is not

6   operating;

7   determining if the fan is operating at or above a maximum duty

8   cycle;

9   multiplying the maximum fan torque loss by a ratio of an actual fan

10   duty cycle compared to the maximum fan duty cycle if the fan type is a variable fan

11   and the fan is operating at less than the maximum duty cycle; and

12   setting the engine torque loss estimate at the maximum fan torque loss
13   if the fan is a variable speed fan operating at or above the maximum duty cycle.

1   7.   The method according to claim 6 wherein the maximum duty
2   cycle is 50% duty cycle.

1   8.   The method according to claim 1 wherein the engine torque
2   loss estimate is reported on a digital communication link in a vehicle, the engine
3   control unit optimally adjusting the operation of the fan according to operating
4   conditions of the engine and the engine torque loss estimate.

1   9.   A system for estimating engine torque loss due to a fan
2   comprising:
3   an engine control unit (ECU);
4   a digital communication link connected to the engine control unit; and
5   a fan connected to the digital communication link;
6   wherein the ECU calculates a maximum fan torque loss by
7   interpolating between a plurality of maximum fan torque loss values based on engine
8   speed stored in a table in the ECU; the maximum fan torque loss being adjusted to
9   obtain a fan torque loss estimate based on a set of predetermined fan characteristics.

1   10.   The system according to claim 9 wherein the set of
2   predetermined fan characteristics comprise whether the fan is a single speed fan, a
3   two speed fan, a variable speed fan, and a dual fan.

1   11.   The system according to claim 9 wherein the set of
2   predetermined fan characteristics comprise the type of fan used and the operating
3   speed of the fan.

1   12.   The system according to claim 9 wherein the digital
communication link comprises a SAE J1939 digital communication link.